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The author classes all these plants under three main parallel divisions, from the lowest of the apetalous,¹ mono- and dicotyledonous groups to their respective highest plants. These three main columns are divided at the same point into three general planes. On plane 1 are all plants of simplicity of floral elements or parts; for example, the black walnut with the simple flower contained in a catkin. On plane 2 are plants of multiplicity of floral elements, as the many petals and stamens of the rose; and, finally, the higher plants, as the orchids among the monocotyledons, and the Compositæ among the dicotyledonous plants, come upon the third plane, or the division of condensation of floral parts.

These three characteristics, simplicity, multiplicity, and condensation of floral elements, are correspondingly repeated in each of the three horizontal planes, and even in individual orders in their lowest and highest plants.² To facilitate the comprehension of this classification I have assembled a sufficient number of the plants themselves, so arranged as to place before you a living representation of this complicated diagram.

(To be concluded.)

HORNLESS RUMINANTS.

BY R. C. AULD.

THE group of mammals known as Ruminants exhibits certain characters more or less dependent and highly typical. Among these is the possession of horns. The Ruminants are the only recent mammals provided with bony extensions of the

¹ Heckel's division of apetalous plants from mono- and dicotyledonous groups has been criticised by some botanists as an artificial method of classification. Since all botanical classifications have been declared, on botanical authority, in a measure, artificial, the author does not feel called upon to apologize for introducing M. Heckel. She has found his scheme to answer her purposes, provisionally, more fully than other classifications, and she is indebted to him for a means of presenting her subject, which would be otherwise impracticable. Further than this she is not responsible for advocating the classification. M. Heckel's table is published with his paper, "Les plantes et la théorie de l'évolution," in the *Revue Scientifique*, 13 Mars, 1886.

² Plate XXV. illustrates this principle for the three horizontal planes, which is also applicable to the orders.

PLATE XXV.

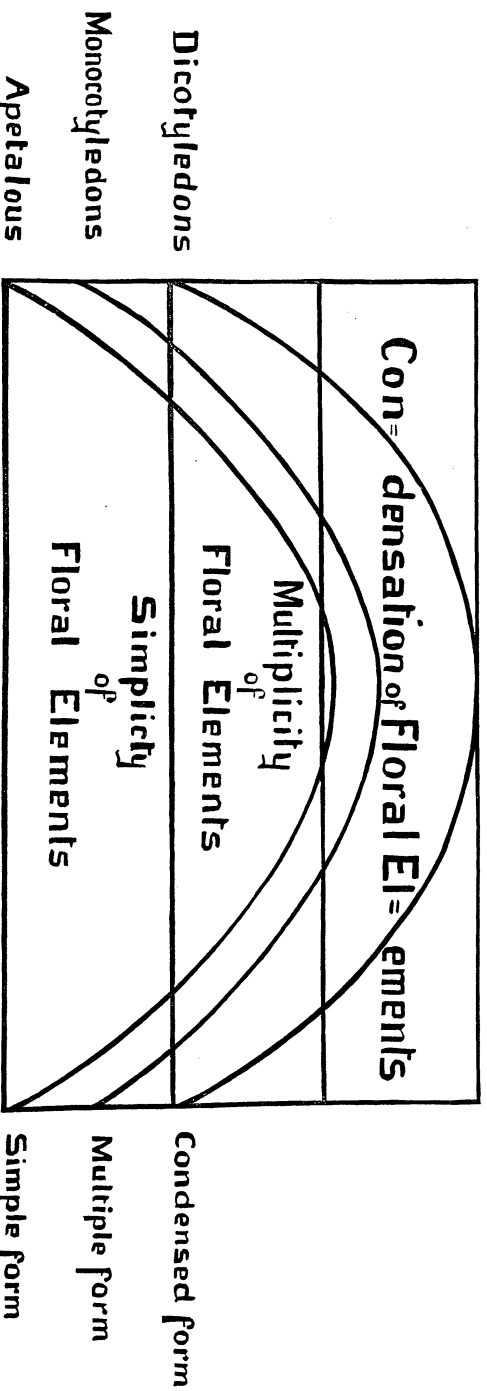


PLATE 1.

frontal bones, to which may be attached, or round which may be sheathed, horny appendages or coverings. But all of the group do not possess these; camels, etc., and two tribes of deer are normally hornless. And among the others, as it is our object to show, the horns are by no means constant, or even necessary. In reference to their horns, Ruminants may be thus arranged:

- | | |
|--|-----------------|
| a. Camels (including Llamas, etc.) | Without horns. |
| b. Giraffes, horns persistent. | |
| c. Deer (including the hornless deer), horns deciduous. | } Solid horns. |
| d. Antelope, Goats, Sheep, Oxen, horns persistent* | |
| | Sheathed horns. |

In reference to the particular character that is to engage attention, the group may be divided in two divisions:

I. Normal hornless Ruminants.

II. Special hornless Ruminants.

I. NORMAL HORNLESS RUMINANTS.

Camels, llamas, alpacas, guanacos, chevrotains, water, and musk-deer are the normal hornless Ruminants, in both sexes. All these have, however, efficient canine teeth.

II. SPECIAL HORNLESS RUMINANTS.

Under this division come all those instances, among others than those just named, which it has been the object to investigate.

Giraffes.—Though the giraffe seems normally to be horned in both sexes, a description of the horns is necessary. The head is adorned with three prolongations of the bone, two of which, in the usual place of horns, are generally described as such. They are covered with a velvety skin similar to those of the deciduous-horned deer at their first growth, but which does not fall off; and at the tip they are surmounted by strong bristly hairs. In the adult the internal structure is hard and solid, but in the young there has been observed an appearance of a cellular centre, nourished by vessels. The third protuberance is in the centre of the skull, and appears as a rounded knob, and is of a very spongy texture (*Fardine*). Both sexes are born with the horn of a certain distinct development; they are persistent

* I know of exceptions to this.

throughout life. I have not discovered any instances of the absence of these peculiar horns. But their structure in their earlier stages seems somewhat similar to some developments in hornless deer, etc.

Deer.—In deer the horns are solid. They have a peculiar manner of growth familiar to most. After the third year, when their horns are named “antlers,” they are annually shed and annually reproduced in a more and more complex manner till they attain their limit of “royalty” and maturity. This process, as will soon appear, it is of the utmost interest to notice. It may be termed the individual-life development, and this it will be of importance to compare with the species-life development. With a single exception of the Arctic reindeer, all female deer are normally hornless. The exception in this case must prove of advantage to the female of this species. It may enable her, by the shovel-like processes that overhang the brow, to procure access to food in her snow-bound home. Abortive or rudimentary horns occasionally appear in female deer. The male also is *frequently* without them.

Lord Walsingham and Sir Ralph Payne-Gallway, Bart., in their book on “Shooting” (Badminton Library) give some interesting notes on Deer by Lord Lovat, who says, “Sometimes stags have no horns. These are called humle stags. If naturally so, and otherwise perfect, they will thrash any other stags of their own, or even considerably greater weight. We have known several of them undisputed masters of large herds.”

The late Mr. Horatio Ross, the famous sportsman of Ben Wyvis, Inverness-shire, Scotland, shot a hornless stag in the autumn of 1880. Mr. Ross then wrote: “When I tell you that I never before saw a similar stag dead, you see that it must be a rare specimen. It is a ‘hummelled’^{*} stag. I have frequently in this great forest seen hummelled stags,—that is, full-grown stags without horns. I once shot a stag of that description at Invermark. The stag killed the other day is a splendid animal, weighing 16 stones, perfectly clean.”

In a note in the “Naturalist” department of *The Field* (London) I made reference to one of the hornless stags of Ben Wyvis, and to that note Mr. Edward Ross, son of the gentleman just mentioned, writes thus, March 1, from The Rounds, Wimbledon:

^{*} Scotch for hornless.

"Allow me to say that hornless or 'hummel' stags, as they are termed in the Highlands, although seldom shot, are not quite so rare as is often supposed. When a herd of stags is found the telescopes of the sportsmen are usually directed towards those with the finest horns, and thus the 'hummels' are apt to escape notice in the crowd; but whenever a herd of several hundred stags is collected together, it will be found, oftener than not, if carefully examined with the glass, to contain one or more 'hummels.' The stag whose head your correspondent refers to was shot by me six years ago in Ben Wyvis Forest, Ross-shire, where it had been known for several years. At the time I shot it it was in company with about three hundred and fifty other stags, among which I observed two other 'hummels' younger than the one which I killed.

"In point of size and condition, these stags are in no respect inferior to their horned brethren. The stag referred to weighed over sixteen stones, and I recollect seeing another, shot by the Duke of Westminster in the Reay Forest, Sutherlandshire, which also exceeded sixteen stones weight, both of these being weighed 'clean,'—that is, without heart, liver, or entrails.

"Strange as it may seem, a full-grown 'hummel' is sometimes very formidable in fight. I have seen one during the rutting season in possession of a large herd of hinds, who succeeded in driving off all his horned rivals.

"Although devoid of horns, the heads of those which I have seen have had slight excrescences, concealed by hair and covered with skin, at the top of the head where the horns ought to have grown. I have never examined the bare skull of one of these deer, but the excrescences which I have noticed have not had either the size or the shape of the stump of bone attached to the skull from which horns grow, and have had no appearance of ever having borne horns. I have never doubted, nor heard it questioned by others experienced in Highland deer-forests, that these stags are hornless from their birth.

"'Haviers,' as stags which have been altered when calves are termed, have no horns, as is well known, and in the early part of the season these, seen through the glass, might be mistaken for 'hummels'; but as the season advances the necks of the latter swell, and (except in the matter of horns) they assume all the characteristics, both in appearance and behavior, of ordinary stags, and are thus easily distinguished from 'haviers.'"

H. von Nathusius, Altaldensleben, province of Saxony, supplies the following interesting notes:

"Hornless stags are of no rare occurrence in some parts of Germany. I know of their occurrence in a wild state in the Harz Mountains and in the royal deer-forests of the Görde in

the province of Hanover, and Letzlingen in this neighborhood (province of Saxony). They are called by the people 'büffel,' 'flattköpfe' (flatheads), 'hermits,' and perhaps by other popular names. The last name is derived from the former opinion that they are not fertile, although it is beyond doubt that they are so, and produce a large percentage of hornless progeny. They are killed wherever they are met with in well-preserved forests, and therefore are now scarce. The cause of this defect is attributable to insufficient food and close inbreeding. The Görde and Letzlingen are fenced with timber, mostly fire-wood. So far as I know them from my own experience, these hornless deer are very massive, but not high on the leg, and, as they are much persecuted, they are seldom full grown. I shot one at a royal battue in the forest of Letzlingen on November 13, 1874. He was rising three years, judging by the teeth, but badly developed and very poor in venison; he had evidently been rutting, and, from the big neck and mane, could not be mistaken for a hind, though there was but a very small protuberance on the head. I preserved the skull. The 'Hornzapfen'—*i.e.*, the bony excrescence on which the horns had to grow—in this case slightly

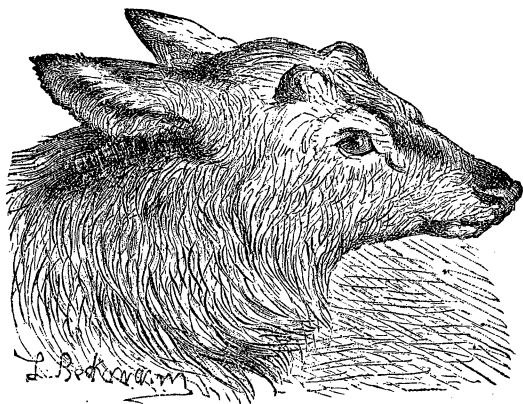


FIG. 1.—Head of Hornless Stag.

pierced the skin, but were covered by hair. This varies, however, in hornless stags. I have another skull where the 'Hornzapfen' were entirely covered by the skin; and it is no rare occurrence to find an undeveloped formation of horn on the bone, but only the base or Rosenstock, as it is technically termed, with a flat top reaching through the skin, but covered almost with hair. Such skulls from the Harz are in the possession of Baron Gussert and Herr von Asseburg. The man who perhaps knows most about hornless stags is the Königlicher Förster Pookh, Forsthaus Röthen, Görde, province of Hanover.

"In the *Illustrirte Zeitung*, published in Leipzig, October 2, 1886, there is a head of a hornless stag (Fig. 1) and a fight between a horned and a hornless stag, drawn from life by Beckmann, an artist who often contributes sporting sketches to the English illustrated papers. This picture confirms the opinion that hornless stags hold their own against antlered ones. It is perhaps of interest that at Letzlingen, where some thousand fallow deer are kept, together with some hundred red deer, hornless bucks never occur among the former."

One of these skulls is now in the Museum of the University of Cambridge.

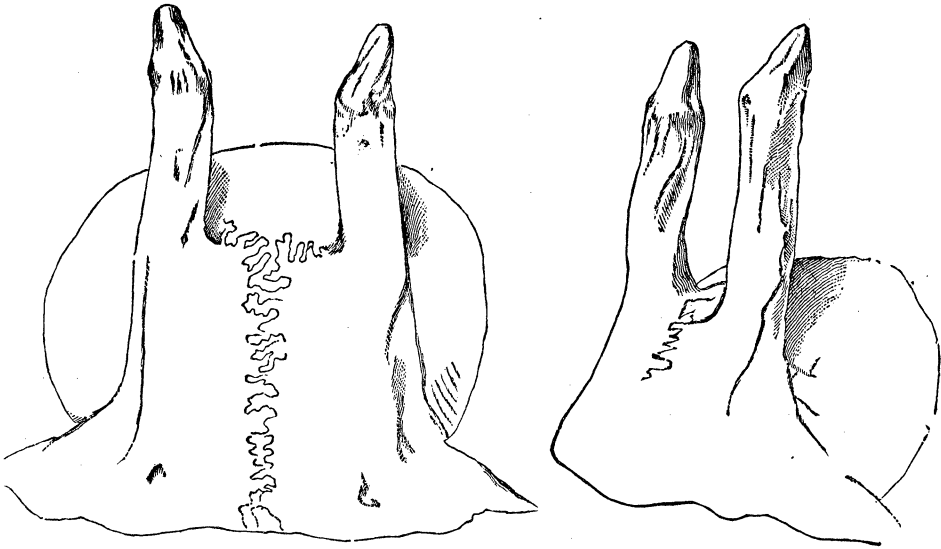


FIG. 2.—Skull of adult Hornless Roebuck (life-size) shot, July 7, at the halduishle, province of Saxony, Prussia.

"Since the above was written," Herr von Nathusius writes me, "I have got notice of a hornless roebuck (*Cervus capreolus*) that had been shot some years ago in this neighborhood. I enclose a sketch" (Fig. 2). The following notes are from Ludwig Beckman:

"Having long been familiar with hornless stags as annual visitors to the Göhrde Forest, perhaps the following notes on the subject may be of interest:

"In the German sporting literature both hornless and single-horned stags are mentioned since the seventeenth century. The former were regarded as unfertile, and called 'monks'; the latter were known as 'murderers,' because they were suspected to be

dangerous to the normally horned stags in fighting. In none of the deer-forests were they found in any number, but appeared here and there singly, seldom leaving any progeny, as they were generally soon destroyed. In Behlen's *Forst und Jagdzeitung* for the year 1831 there is the following notice: 'Remarkable stags in Göhrde.—There have been observed of late years stags with only one horn. The keepers and foresters assert that these single horns are shed annually, and that the animals show no signs of infirmity.' In the same year (1831) a hornless stag was killed in another forest (Evensen) near Hanover, which had evidently been rutting hard. In July, 1832, a hornless stag, weighing nearly two hundred kilogrammes, was killed in the shootings of Graf Bernstorff, Gartow. This stag was first observed in the rutting season 1829, with a herd of fifteen to eighteen hinds, chasing the horned stags by striking at them with the fore-legs. In 1850 I found skulls of single-horned stags in several collections at Hanover, and heard from the royal foresters that there were more in Göhrde, and that this variety would be preserved. Subsequently the destruction of the hornless stags at Göhrde was often contemplated, but, to my knowledge, was never earnestly carried out, for it was evident that the experiment would not be of much use. Hornless stags are often regarded as a peculiar variety, but then so are stags with only one horn,—in fact, there are so many individual variations of this kind, that it is impossible to draw a line between stags with and without horns in places where hornless stags have long existed.

"In the Göhrde Forest, where neither 'flat-heads,' or hornless stags, nor single-horned stags, are rare, I found, in 1883, among the forty-five stags killed at the royal battue, perhaps five or six warrantable stags, with fully-developed horns; twenty-five middle-sized and small, but with rather regularly-shaped horns; one old stag with only one fully-developed antler on one side and a short boss* on the other side; some heads with an antler only half developed, and one boss projecting, more or less, through the skin of the forehead. Then followed two perfect hornless heads, with bosses, but, of course, covered entirely with skin. Among other deer killed that day were several young stags with thin, slender horns of a white color, resembling bleached horse-ribs ('switch-horns'), while others were bent and twisted like corkscrews. The difference between the undeveloped bosses of a hornless stag, like Fig. 3, and that of a warrantable stag, with well-developed horns, may easily be seen by comparing Fig. 3 with Fig. 4, the latter having been sketched after the annual shedding of the horns. Some hornless stags have only small, flat rudiments of bosses, which are not visible until the skull is stripped of its skin.

* In German, Hornzapfen or Rosenstad.

"The bosses of a flat-head, or hornless stag, never produce or bear horns. These flat-heads, as well as the single-horned stags, are nevertheless fertile, their necks swelling, as usual, towards the rutting season, when they are roaring and fighting with the horned stags. They attack a rival by raising themselves on their hind-legs and striking at them with the fore-legs. Generally the horned stag adopts the same mode of fighting, without using his more dangerous weapons, the horns, as I have often observed.

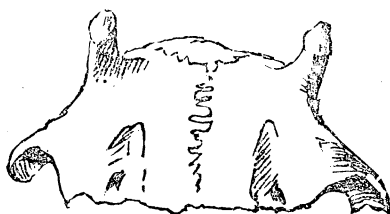


FIG. 3.—Skull of Hornless Stag.

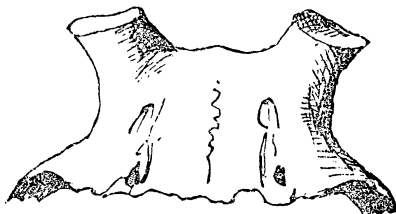


FIG. 4.—Skull of a Horned Stag, after shedding the horns.

But I have been told by foresters and keepers that they have sometimes seen hornless stags fighting with antlered rivals forehead to forehead; and Oberförster Wallmann, in Göhrde, once saw a hornless stag in this way pressing and driving away a horned rival from a lot of hinds. I can only explain this by the fact that hornless stags are often superior in bulk and weight to horned ones. The loss of horns in male deer is certainly not the result of long inbreeding. In the Göhrde Forest, where from five hundred to six hundred deer roam over an area of five thousand hectares, and where the fences have openings (einsprünge), so that the wild deer may enter at any time, no such inbreeding takes place. It is well known in that district that in former times wild stags came during the rutting season even from Mecklenburg, across the Elbe. In the royal forest near Springe, in Hanover, which is surrounded by high walls, and where the deer have been breeding in and in for forty years, the stags have nevertheless well-developed horns, and Oberförster Hesse, of Springe, told me that not a single hornless stag had been observed during all that time."

The musk-deer, smaller than the roebuck, differ from the general character of deer in having no horns in either sex. "To compensate the want of horns" the males have two long and slender canine teeth, which project from the jaw like elephants' tusks, only that they curve inwards. In this tribe the canines, instead of being arrested in their embryo stage, as in the other common Ruminants, gain full development. The musk-deer (*Moschus moschiferus*) are natives of Thibet and Nepaul.

The water-deer (*Hydropotes inermis*) is a singular deer without horns, and with large projecting canine teeth. It is found in China in the low meadows and scrubs bordering the rivers, and is remarkable for its excessive fertility, the female being said to produce six or seven young at a birth.

"In the large riverine islands of the Yangtze, above Chinkiang," Mr. Swinhoe tells us, "these animals occur in large numbers, living among the tall rushes that are there grown for thatching and other purposes. The rushes are cut down in the spring; and the deer then swim away to the main shore and retire to the cover of the hills.

"In autumn, after the floods, when the rushes are again grown, they return with their young, and stay the winter through. They are said to feed on the rush-sprouts and coarse grasses, and they doubtless often finish off with a dessert from the sweet-potatoes, cabbages, etc., which the villagers cultivate on the islands during winter.

"Fortunately for the deer, the Chinese have an extraordinary dislike for their flesh. They are therefore only killed for the European markets, and sold at a low price. The venison is coarse and without much taste, but is considered tolerable for want of better; it is the only venison procurable in Shanghai."

Specimens of the latter are to be seen in the Zoological Society's Garden, London.

Passing from living to extinct forms of deer, there has to be noted the discovery of polled or hornless skulls of the extinct Irish elk. But some much more remarkable discoveries have been made in the history of the species-life or development. It is found that the horn-development, in complexity, is exactly parallel to that seen in the development of horns in the individual of to-day. Professor Boyd-Dawkins¹ states that in the lower miocene "no member of the family is possessed of antlers." They are hornless,—polled. In the mid-miocene strata Professor Gaudry notes small branching erect antlers persistent throughout life, and characterized by the absence of a burr. This is considered by Professor Leidy as a form intermediate between the antlers of deer and the horns of the antelope. It may fairly claim to be the most rudimentary form of antler belonging to a type no longer represented. The true starting-point of the antlered deer of the post-miocene age is presented by the simple forked crown of the *C. dicruceros* of the mid-meo-

¹ Early Man in Britain.

cene. The cervine antler of the upper meiocene becomes more complex, but is still small and erect, like that of the roe. In the pleiocene it becomes longer and longer, and altogether more complex and differentiated, some forms, such as the *C. dicranios*, being the most complicated known either in the living or fossil state. These successive changes are analogous to those which are to be observed in the development of the living deer,—which begins with a single point, and increases the number of tines till the limit is reached. It is obvious from the progressive diminution in size, and complexity of the antlers in tracing them back from the pleiocene into the mid-miocene of Europe, that in the latter period we are approaching the zero of antler development. In the lower meiocene Professor Boyd-Dawkins has failed to meet with evidence that the deer possessed any antlers.

Thus in deer the polled head was the condition of the family during its embryo age of development, as it is in the living individual to-day. This was during the upper eocene period, “when generalized or ancestral forms of deer and antelope” were universally of the hornless type, whose associates were, also, tuskless *Suidæ* and hornless *Rhinoceri*.

Antelopes.—The indications, as just pointed out, of the earliest forms of antelopes are that in such stage they were unpossessed of horns. Darwin notes that, “with the antelopes a graduated series can be formed, beginning with the species the females of which are completely destitute of horns, passing to those having small rudimentary to those which have fairly well-developed horns, to those in which they are of equal size in both sexes.”

A form between the deciduous solid-horned and the non-deciduous hollow-horned has been pointed out by Professor Gaudry.

The position from which the horns spring is a chief point to note in antelopes, as also that the bony nuclei of the horns are hard and solid, while in the other Ruminants to be noticed they are cellular and communicate with the frontal sinuses.

It would be interesting to make an anatomical comparison between the horns of the giraffes, the rosenstock of hornless deer, the horn-stock of antelopes, and the subcutaneous osseous rudiment sometimes felt in hornless cattle, but space does not permit.

Goats.—Goats, which have been domesticated from the earliest times, occur hornless in both sexes. Jardine's description is, "Horns common to both sexes; rarely wanting in the female; in domesticated races occasionally absent in both." Describing several species of "common goat," he says, "As among the sheep, we have also a breed, white, and without horns, and here the distinction of the two forms is very close indeed, and scarcely to be distinguished, except by the hairy fleece and indication of a beard." He also describes and figures "two more grotesque-looking goats, which have been generally placed as varieties of the domestic breeds, and are represented on the next plate, taken also from the figures of Fred. Cuvier. They are the Nepaul goat and the goat of Upper Egypt. These two animals would almost seem not to be varieties, but distinct species, though, perhaps, there is not so much difference as we see in some of the races of dogs; and this is one of those points in natural history which is extremely difficult to prove, even with the most extensive menageries and most favorable situations. The most marked character in the black figure, the Nepaul goat, is its high and slender figure. The arched form of the nose, occasioned by the convexity of the nasal bones; and the long and pendulous ears, generally of a white color, or paler than the tint of the body. The other figure on the plate, the goat of Upper Egypt, is generally of a brown color, standing high, and somewhat of the form of the Nepaul goat. The hair longer and more shaggy, the bones of the nose very much raised, and the appearance of the chin and face, with the exhibition of the teeth, putting one in mind of the pugs among dogs. The ears are also ample and pendent; from the neck there is frequently hanging two fleshy tubercles, an accessory which is also sometimes seen in some breeds of sheep. In the female, the udder is always very pendent, sometimes almost touching the ground." The figures in the plate are *both* hornless.

Professor Low¹ says of the domestic goats, "Sometimes the horns disappear in one or both sexes; and in certain cases they become polycerate." Extending over the varied surface of Hindostan, the goats assume a prodigious diversity of color, aspect, and form. Sometimes they have horns, and sometimes they are destitute of horns. The Syrian goat, though so called, is not

¹Domesticated Animals of Britain.

confined to Syria, but extended, by the countries of the Euphrates, into Arabia, and, with some slight change of characters, into Upper Egypt and Nubia. This kind of goat was known to the ancients, who mention it by the name of the Syrian, and sometimes by the Damascus goat. It is generally without horns. In Nepaul a beautiful goat is domesticated, which so much resembles the Syrian that both appear to be derived from a common stock.

Figuiér states that of the common goat (*C. hircus*) "there is a subvariety without horns," and that the Syrian goat, pendulous-eared, is more frequently without horns than the common goat.

The writer of the article on Goats in the "Encyclopædia Britannica" (ninth edition), noticing the Maltese hornless variety, remarks, "but the absence of these appendages is likely a freak of nature and not the peculiar character of a particular species."

Mr. Henry Stephen Holmes Pegler, Secretary of the British Goat Society, in his well-known work, "The Book of the Goat" (1885), says,—

"A French writer, on the authority of an 'Encyclopædia of Natural History,' classifies the varieties into four distinct groups: 1. Goats with short prick ears, as the common goat, the hornless goat, and the dwarf goat of Guinea. 2. Goats with long, wide, pendulous ears, as the Syrian and Nubian, or Egyptian. 3. Goats with drooping ears and curly woolly coat, represented by the Angora. 4. Those having semi-pendulous ears and a downy undergrowth of wool, as the Cashmere. . . . As regards hornless goats, which this author places among the prick-eared varieties, it is a question whether there exists a breed without horns which may be relied on to reproduce that peculiarity without deviation. I am inclined to share the opinion of Professor Simonds, late Principal of the Royal Veterinary College, that there is no hornless race, but that the absence of the corneous appendages is purely a freak of nature apparent in all breeds, though doubtless in some more than in others, according to the fancy of a people for encouraging and perpetuating the peculiarity. At the same time, there can be no doubt but that by a careful selection, and breeding always from polled goats, a strain could be established which would produce, with tolerable certainty, hornless stock. The French writer referred to says, 'The goat without horns appears to have a rather ancient origin, for the modifications which characterize it are deeply rooted. We know in other respects but little concerning this pretty creature, whose most esteemed quality consists in the value of its flesh, which possesses but little odor, and is very good eating,

being often mistaken for mutton.' He then concludes by saying,

The hornless goat is of Spanish origin.' Now the country where hornless goats are most common is Malta, and the close proximity of that island to Spain would lead to the inference that the Maltese is the kind here alluded to, especially as it is not mentioned elsewhere in the work. If this be so, however, the grouping is certainly at fault, seeing that the Maltese goat has decidedly pendulous ears, and cannot, therefore, be placed in the same category as the prick-eared varieties." (Pp. 18-21.)

He, on pp. 27, 28, describes "The Maltese goat" thus:

"If a really hornless breed of goats exists, it is the Maltese, there being more polled specimens among this variety, I believe, than any other. The greater proportion, indeed, are of the hornless type, and white or grayish-white in color, with brown or black spots. It is long-haired, of rather large size, with a long neck and head, the facial line being nearly straight. The ears are of considerable length and width, and as pendulous as those of a double-lopped rabbit. All the goats of this breed that I have kept myself, or seen, were thin, bony creatures, with very flat sides."

But all are unanimous in placing this variety foremost among milkers,—an important point to note.

On pp. 101-3, under the heading "Importance of Pedigree," he gives an analysis of a pedigree which he says he selected "as showing how, whilst most of the ancestors are hornless, a horned goat is produced."

In a paper by the same author in *The Live-Stock Journal Almanac* (1887), in referring again to the importance of the Record he says,—

"A perusal of this volume clearly demonstrates also what I have often stated, that the hornless, short-haired goats are far the most popular, and pay the best to breed. . . . Of course, I am aware, and admit, that there are also many equally good animals among horned goats. But hornless stock are unquestionably more in demand. Long-haired goats, on the contrary, with their correspondingly long and dangerous horns, are never popular, and very few indeed are now seen, as they are not taking in appearance."

The British Dairymen's Association, at their annual exhibition in London, has four classes for the reception of hornless varieties of goats.

Varo and Columella inform us that in their times the Romans

dishorned (as is now such a common practice in the Western States of America, among cattle) their goats and sheep of certain kinds. This would indicate that they were acquainted with the useful properties of hornless races of these Ruminants, which we, indeed, know to be the fact with the latter.

Sheep.—Generally considered sheep are described as having "horns common to both sexes, sometimes wanting in the females." The domestic breeds are, however, mostly polled.

Aristotle (4, xxvii.) states that in Libya the horned rams are born at once with horns, and not the males only, as Homer says, but all the rest also. In part of Scythia, near the Pontus, the contrary is the case, for they are born without horns.

Jardine figures a peculiar breed of Persian sheep. It is polled, with black head, ears, and neck, the rest of the body white: has pendulous ears and arched profile, stands somewhat high, and has short, crisp wool. It seems to resemble the breed of African and Ethiopian sheep. It also appears to spread itself into many varieties,—the Morocco breed, the Congo breed (covered with very loose wool instead of hair, with two wattles beneath the throat), the Guinea breed, and the Angora races (which have finer wool).

He also mentions the hornless Mysore as the most beautiful Indian breed. In Russian Tartary are polled, lop-eared, Roman-nosed sheep.

Prof. Youatt says ("Sheep"),—

"The primitive breed was certainly *horned*,^{*} and those horns were of considerable size. . . . The polled sheep were probably an accidental variety, and when first occurring, cultivated partly for their singularity, and more for their utility, whether with reference to the additional closeness or folding of which they were capable, or the fewer accidents that were likely to occur, or, most of all, from the supposed docility and quietness of those to whom nature had not given these weapons of offence, and of the use of which all animals soon become too conscious. There is not, however, a polled breed of the present day in which lambs are not occasionally dropped with the rudiments of horns; some of these horns grow to their full size, and others are curiously attached to the skin alone, and either hang loosely down or drop off."

The first two figures he gives are (1) that which is common in the north and south of Asia, prevailing more than any other in

^{*} Page 363 he says "*probably*" instead of "*certainly*."

Palestine, interior and north of Russia, and of which the Turcoman Kalmuck flocks, etc., principally are composed. It is fat-rumped and horned. The second cut (2), representing a ram of the Primitive Sheep, is that of the "fat-rumped polled sheep, prevailing in Persia." It is the same as mentioned by Jardine. Youatt discusses whether this breed,—the fat-rumped,—which mostly prevails in Palestine, is the same with that of which the sacred historians speak? He shows that the patriarchal breed was the sheep whose fat was principally deposited, not in the tail, but on the rump, or in those parts immediately connected therewith. The Persian polled sheep was the more beautiful specimen of the primitive fat-rumped breed.

"The level back and belly," says Youatt, "the rounded carcass, and the light small leg would induce the easy belief that from such animal our own down and mountain sheep might have originally sprung." This is a view similar to the opinion as to the Zebu being the ancestor of our domestic races of cattle.

In describing the Egyptian, Ethiopian, and Abyssinian fat-tailed sheep, he says in Nether Ethiopia the fat-rumped variety begins again to be found of rather smaller size than the Persian. The smaller sheep, resembling, and, except in size, identical with the Persian or primitive breed, is more prevalent. The cut given on p. 23 (the polled fat-rumped Persian) represents the usual Abyssinian, but of a somewhat larger size.

Many of the sheep of East India, and particularly the Mysore, closely resemble the Persian. They are without horns.

Professor Low says the polled Persian is found in Arabia, the countries of Euphrates, into Persia, whence it has been sometimes erroneously termed the Persian breed, though in no degree proper to Persia. They are found in Madagascar and along the southeastern coast of Africa, Abyssinia, and the countries of the Red Sea.

Youatt, in a note, mentions "a broad-tailed polled black ram at present in the Zoological Gardens, Regent's Park, that has floored most of his keepers, and is master over every sheep and beast in the place." This is of interest.

Columella has recorded his preference for the "hornless breed" of sheep.

Early English writers record their preference for the polled

varieties of sheep,—Markham, Sir Anthony Fitzherbert, Barnaby Googe, and W. Ellis.

Pennant divides sheep into two classes: (1) *Ovis anglica*—the Hornless, and (2) *Ovis polyceras*—the Many-Horned.

Gilbert White, writing from Ringmer, near Lewes, December 9, 1773, to Thomas Pennant, has the following on hornless sheep:

“One thing is very remarkable as to the sheep; from the westward till you get to the river Adur all the flocks have horns, and smooth white faces, and white legs, and a hornless sheep is rarely to be seen; but as soon as you pass that river eastward, and mount Beeding Hill, all the flocks at once become hornless, or, as they call them, poll-sheep; and have, moreover, black faces with a white tuft of wool on their foreheads, and speckled and spotted legs, so that you would think that the flocks of Laban were pasturing on one side of the stream, and the variegated breed of his son-in-law Jacob were cantoned along on the other. And this diversity holds good respectively on each side from the valley of Bramber and Beeding to the eastward, and westward all the length of the downs. If you talk with the shepherds on this subject, they tell you that the case has been from time immemorial, and smile at your simplicity if you ask them whether the situation of these two different breeds might not be reversed. However, an intelligent friend of mine near Chichester is determined to try the experiment; and has this autumn, at the hazard of being laughed at, introduced a parcel of black-faced hornless rams among his horned western ewes. The black-faced poll-sheep have the shortest legs and the finest wool.”

John Lawrence, in 1805, gives a concise “Description of British Sheep,” of which he enumerates eighteen polled races and some foreign races, as Dutch and Danish, which seemed to be varieties of the Spanish (Merino). Mr. Arthur Young, the celebrated author of “The Annals of Agriculture,” wrote that “while in Spain I examined the sheep attentively. They are in general polled, but some had horns,” etc.

Professor Boyd-Dawkins states, “The hornless breeds of sheep date back in our country from the days of the Romans, since the hornless skulls have been found associated with Roman remains in London.” And “from the analogy of cattle it is certain that they were derived from a horned race, such as the Welsh or old Irish or Exmoor breeds. Nevertheless the horned is more abundant in the Roman refuse-heaps than the hornless, and in those days was the dominant breed.”

H. von Nathusius writes me from Saxony :

"In Germany there are some polled sheep, particularly of the large, short-tailed, marsh breeds, that now mostly have been crossed with the long-woolled English. There are few of the aboriginal ovine tribes left untouched by Merino blood. Among the Merinos there is no regularity at all concerning horns. There are breeds in which almost all the ewes have small horns, and others, particularly in France, where even the rams are devoid of them. They have given them premiums, indeed, limited to hornless rams only. I some time ago bred a small flock of a cross between hornless French Mauchamp Merino¹ rams and Lincoln sheep from Lady Pigot's flock, and, strangely enough, a large percentage of the rams and an occasional ewe came with horns.

"In the collection of the University of Halle there is a very interesting suite of ovine skulls, beginning with such of the most strongly-developed horns, and consequently 'Hornzapfen,' down to the hornless tribes, where there are not any rudiments of the bony excrescence left, and finishing with skulls of the Italian Bergomask sheep, the largest breed in Europe, in which both sexes are always hornless, and in which you sometimes find in the place where the 'Hornzapfen' appear in horned sheep, a *depression in the bone.*"

In 1863 the French government introduced some of the famous *Ong ti*, or Chinese prolific sheep. The consignment was divided into three lots, one of which was sent to the Jardin d'Acclimation, where they have increased enormously. They weigh—well, as high as one hundred and fifty-four pounds; the flesh is of good quality. The wool is of mother-of-pearl brilliancy, but of common quality. The head, which is very small, is covered with short, close, and shining hair. The animal has no horns, but what gives the greatest peculiarity to the sheep is, that they have no ears. The legs are long and hairless; the body short; the chest expansive, and loin good; the tail is short and folds on itself in a crease of the skin that encloses a fat of very fine quality. The distinguishing trait of the race is its fecundity, producing from two to five twice a year. Two only are generally raised, though the mothers are excellent milkers.

¹ The male (hornless) of this breed is figured by L. Figuier.